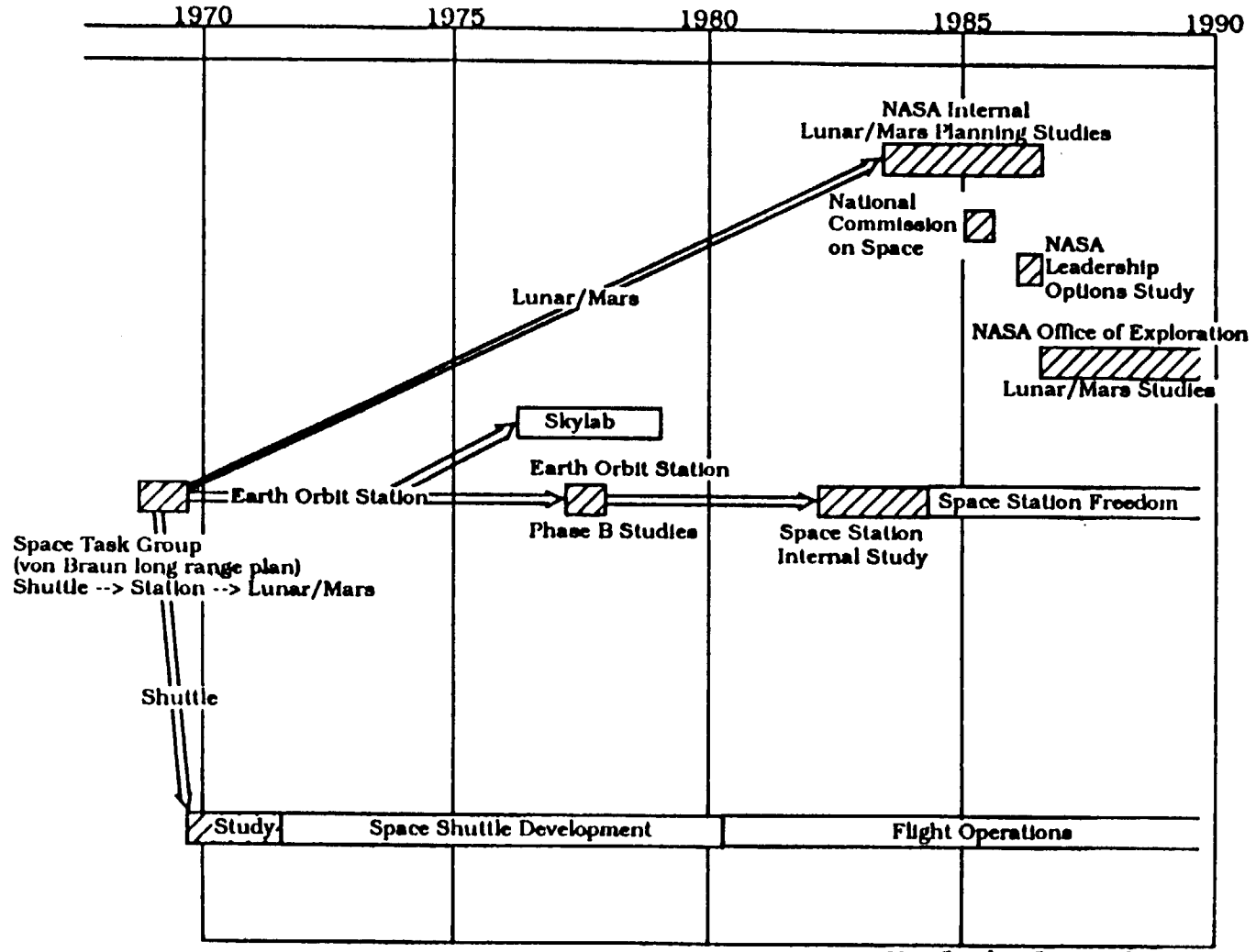
714

PRESENTATION 1.7

N91-17027

EXPLORATION INITIATIVES

POST-APOLLO MANNED SPACEFLIGHT THRUSTS



Technical Study Group

PRESIDENT BUSH
JULY 20, 1989

THE GOAL: "... TO ESTABLISH THE UNITED STATES AS THE PREEMINENT SPACE FARING NATION."

THE COMMITMENT: "... A SUSTAINED PROGRAM OF MANNED EXPLORATION OF THE SOLAR SYSTEM ... AND THE PERMANENT SETTLEMENT OF SPACE."

THE PLAN: "FIRST ... FOR THE 1990'S ... SPACE STATION FREEDOM ..

AND NEXT - FOR THE NEW CENTURY - BACK TO THE MOON.
AND THIS TIME BACK TO STAY.

AND THEN - A JOURNEY TO ANOTHER PLANET - A MANNED MISSION TO MARS.

EACH MISSION ... WILL LAY THE GROUNDWORK FOR THE NEXT."

THE ACTION: "... VICE PRESIDENT ... TO LEAD THE NATIONAL SPACE COUNCIL IN DETERMINING SPECIFICALLY WHAT'S NEEDED ...

- MONEY, MANPOWER, AND MATERIAL ...
- FEASIBILITY OF INTERNATIONAL COOPERATION ...
- REALISTIC TIMETABLES, MILESTONES ...

.. REPORT BACK AS SOON AS POSSIBLE WITH CONCRETE RECOMMENDATIONS"

NASA Exploration Initiative

PRE-JULY 20,1989 STUDIES

PATHWAYS

- Moon only-science
- Moon only-oasis
- Mars only
- Phobos --> Mars
- Moon --> Mars

MAJOR VARIABLES EXAMINED

- Launch vehicle size vs. in-space assembly vs. direct to surface
- SSF vs. new spaceport vs. direct assembly
- Spaceport in lunar orbit
- Various Mars trajectories: sprint, split/sprint, opposition, conjunction, Venus assist
- Chemical vs. electric vs. nuclear vs. unconventional propulsion
- Aerobraking vs. all-propulsive vehicles
- Expeditions vs. evolution
- Expendable vs. reusable spacecraft
- Propellant transfer vs. tank transfer
- Open vs. closed life support
- Zero-g vs. artificial-g Mars vehicle
- In-situ resources vs. Earth-supplied

POST-JULY 20,1989

PATHWAY SET:

- SSF --> Moon --> Mars

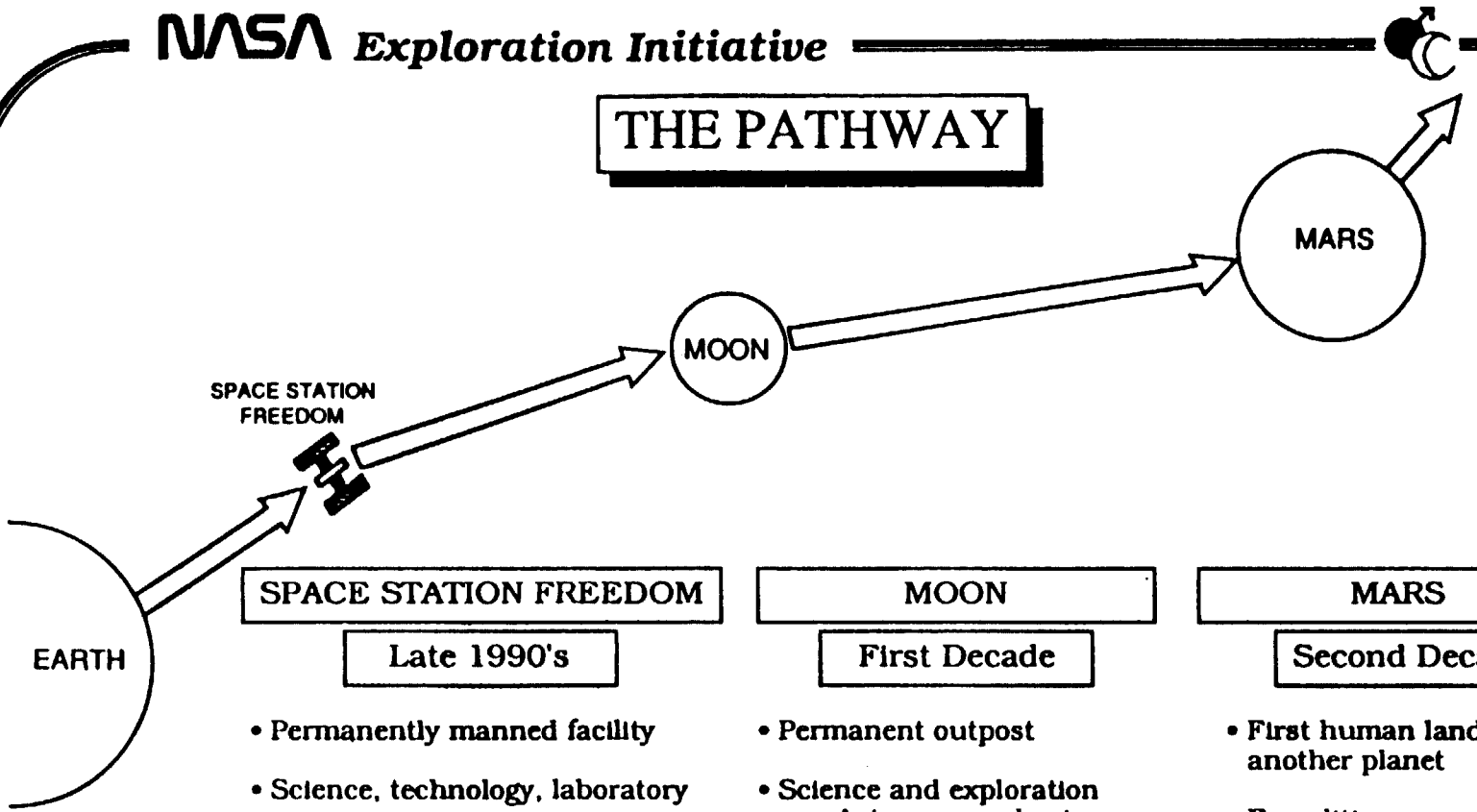
MAJOR QUESTIONS

- Scale of program
- Program schedule
- Lunar emphasis
- Technology level
- Cost

Technical Study Group

NASA Exploration Initiative

THE PATHWAY



SPACE STATION FREEDOM

Late 1990's

- Permanently manned facility
- Science, technology, laboratory
- Spaceport for assembly, checkout, fueling, launch, servicing of lunar and Mars missions
- New technology experiments and demonstrations
- Life sciences/long-term human spaceflight research

MOON

First Decade

- Permanent outpost
- Science and exploration
  - Astronomy, physics, geology, life sciences
- Learn to live and work on an extraterrestrial surface with increasing self-sufficiency
  - Utilize local resources
  - Enable future industry
- Testbed to learn how to go to and survive on Mars
  - Simulate Mars mission

MARS

Second Decade

- First human landing on another planet
- Expedition --> outpost
- Science and exploration
- Live and work with a high degree of self-sufficiency
- Search for life: past or present

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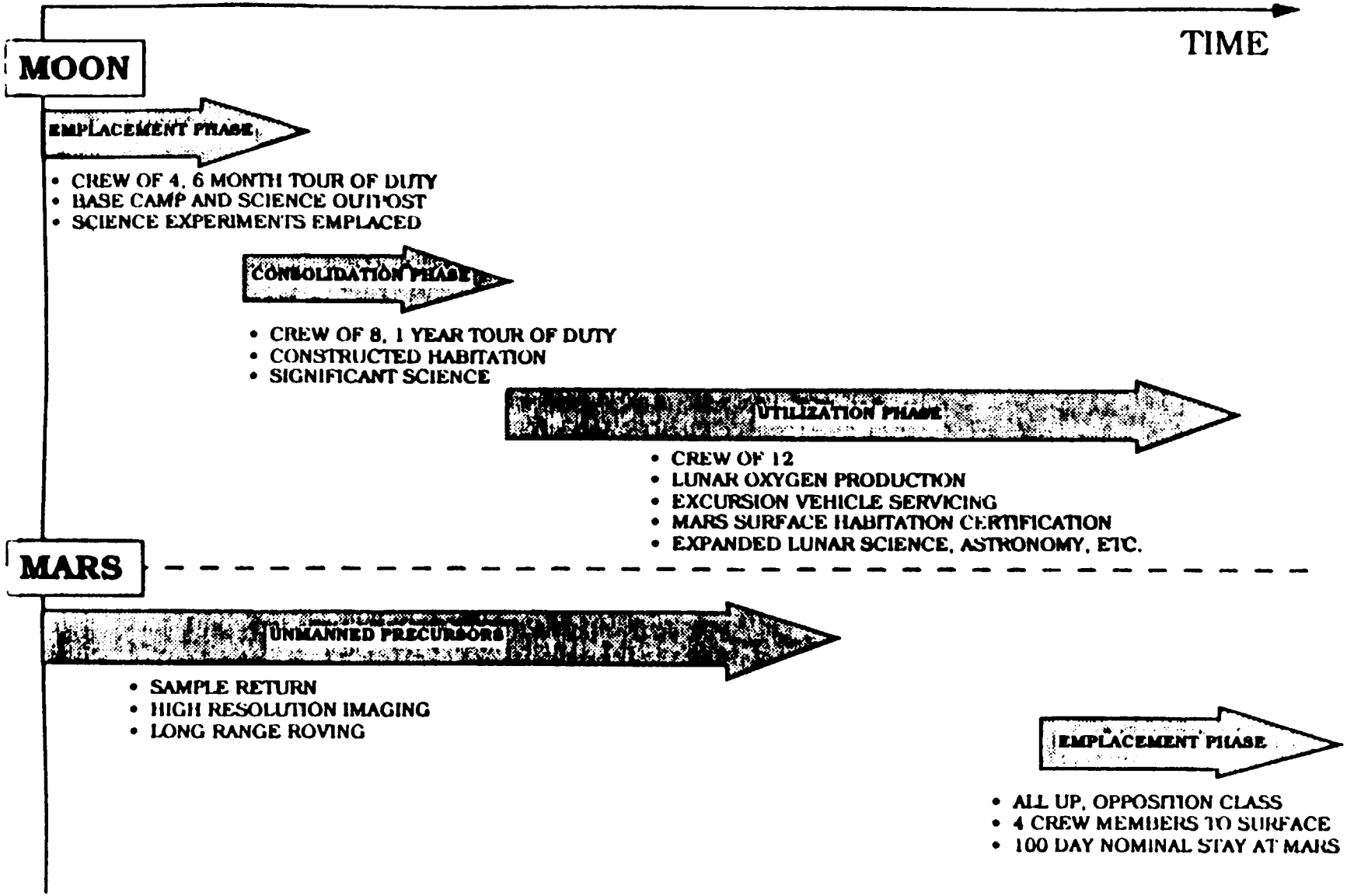
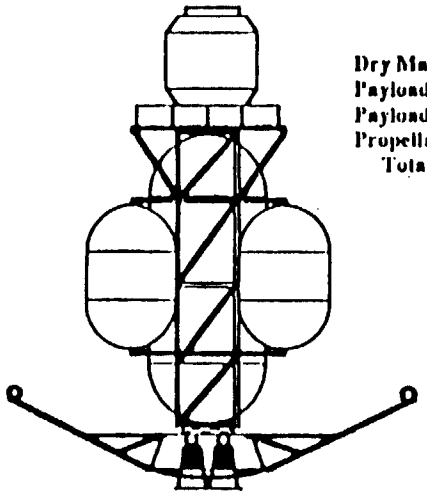
A POSSIBLE MISSION SCENARIO BASED ON EVOLUTIONARY APPROACH



LUNAR TRANSPORTATION VEHICLES
2003 - 2005

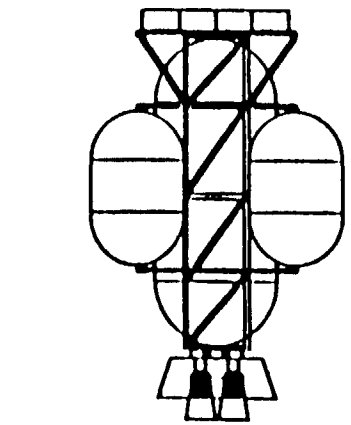
LUNAR TRANSFER VEHICLE



Dry Mass	18.7
Payload Out	54.8*
Payload Back	(1.2)
Propellant	146.6
Total Wet Mass	220.1

Engines:
Type : RS-44 Class
Thrust: 133.4 KN
Isp: 481 secs.
Number: 3

PILOTED CONFIGURATION



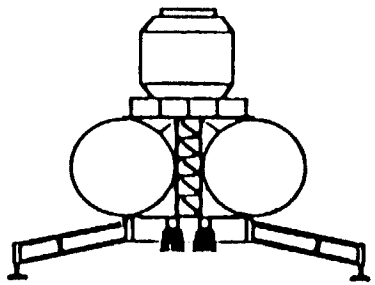
Dry Mass	7.8
Payload Out	64.6*
Payload Back	(0.0)
Propellant	124.1
Total Wet Mass	196.5

Engines:
Type : RS-44
Class
Thrust: 133.4 KN
Isp: 481 secs.
Number: 3

CARGO CONFIGURATION

LUNAR EXCURSION VEHICLE

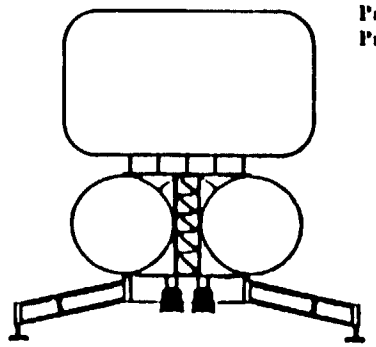
Dry Mass	6.3
Payload Down	23.7
Payload Up	(1.2)
Propellant	24.8
Total Wet Mass	54.8



Engines:
Type : RS-44 Class
Thrust: 266.9 KN
Isp: 465 secs.
Number: 4

PILOTED CONFIGURATION

Dry Mass	3.4
Payload Down	37.0
Payload Up	(0.0)
Propellant	24.2
Total Wet Mass	64.6



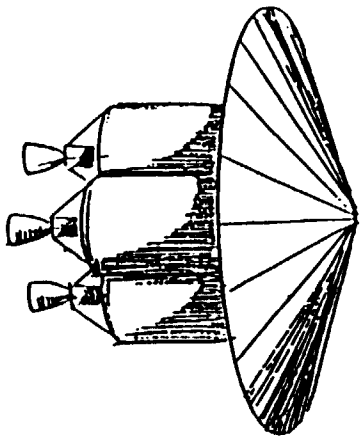
Engines:
Type : RS-44 Class
Thrust: 266.9 KN
Isp: 465 secs.
Number: 4

CARGO CONFIGURATION

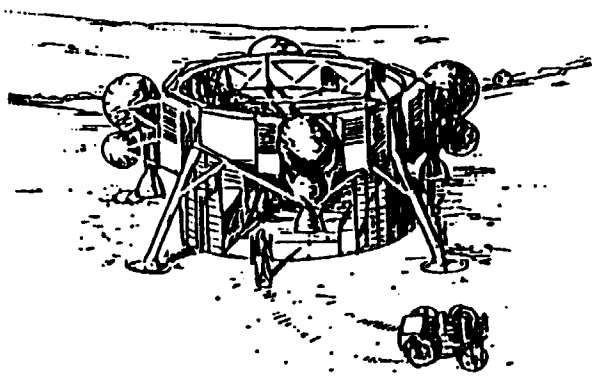
* Payload out includes wet excurs' ehicle and payload

NASA

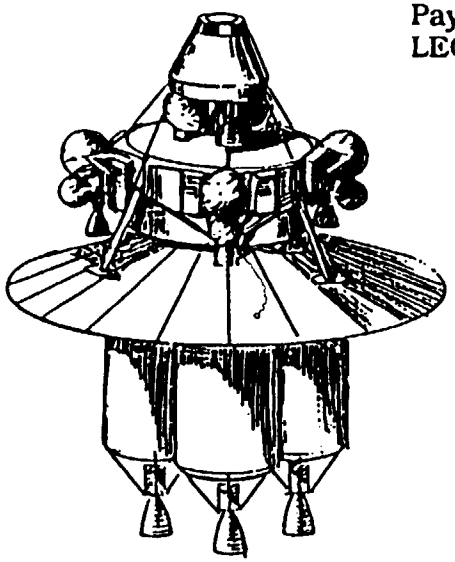
LUNAR TRANSFER, DESCENT, AND ASCENT VEHICLES

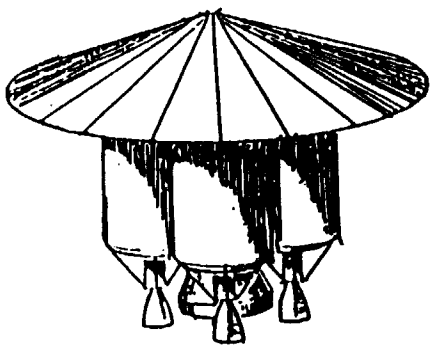


60 ft

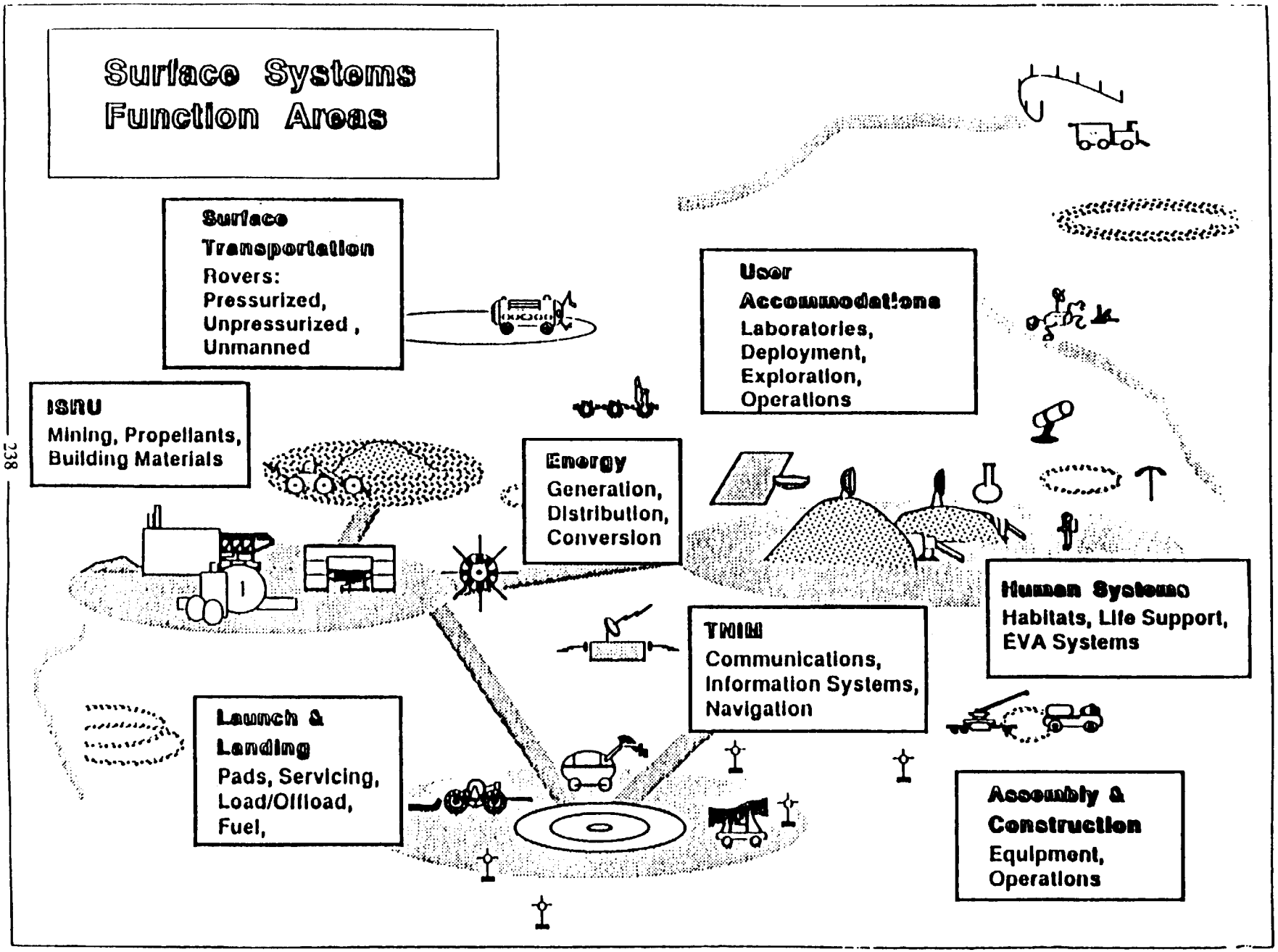


Payload = 44,000 lbs to surface
LEO mass = 316,000 lbs

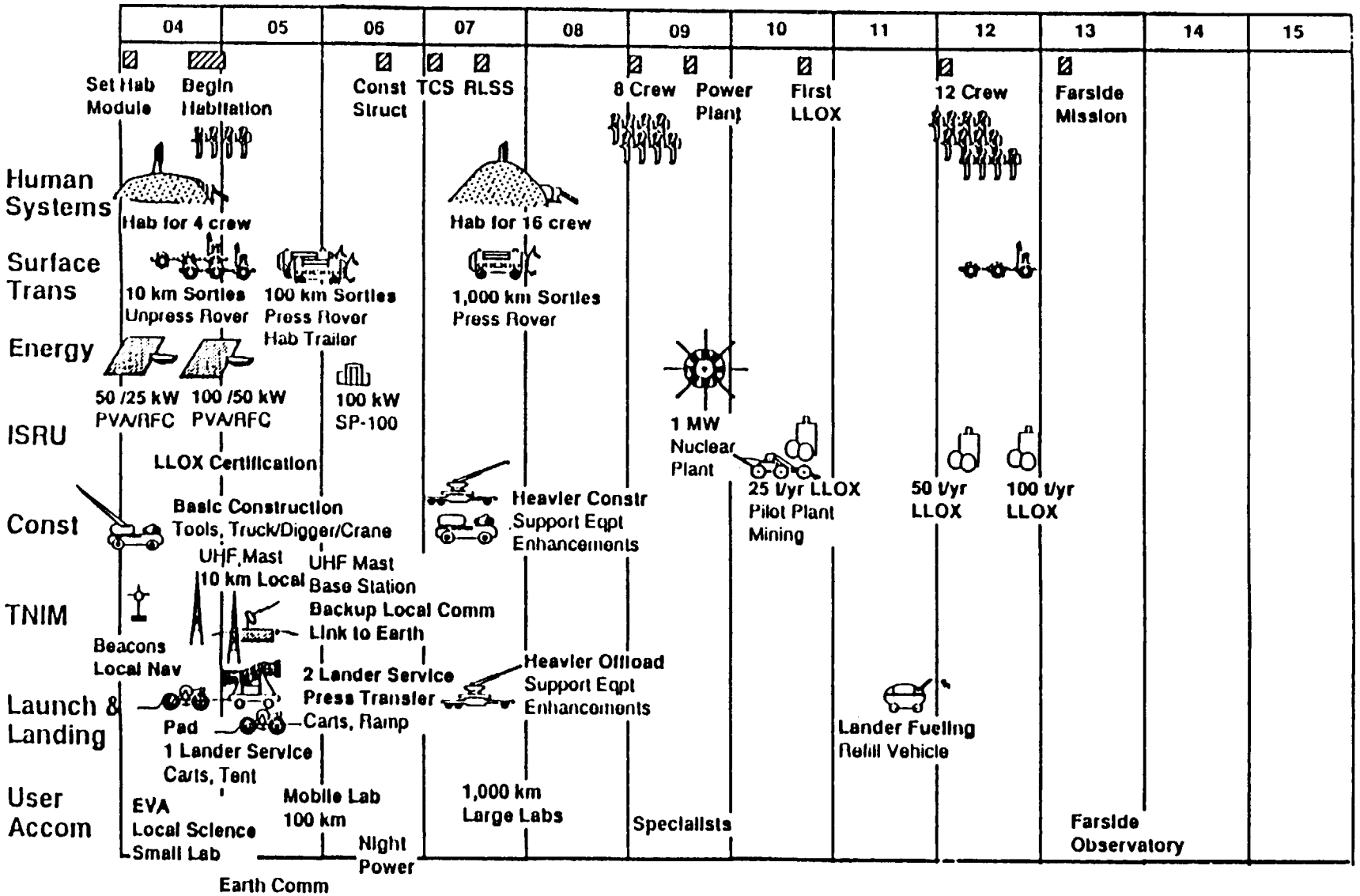




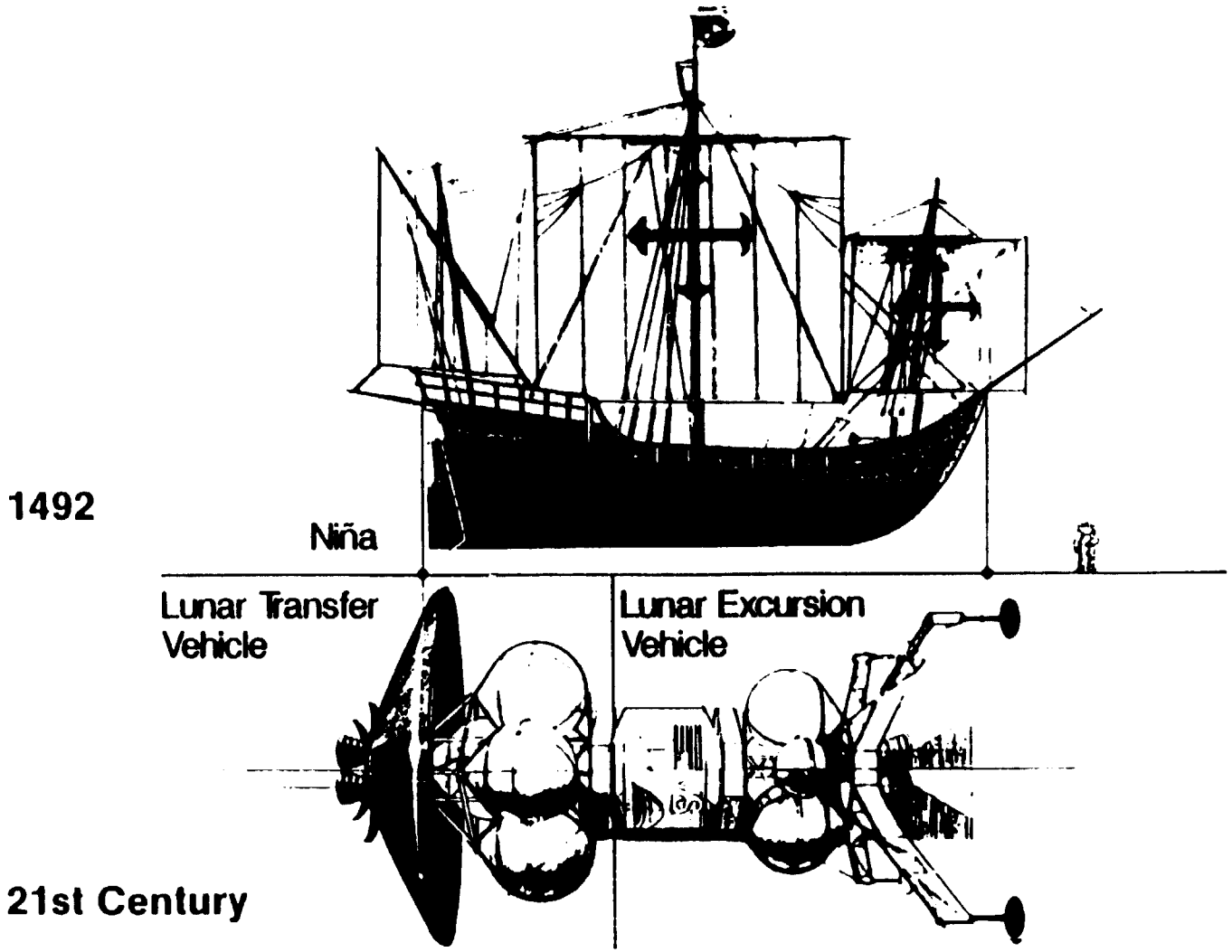
Office of Exploration


Surface Systems
Function Areas
Surface
Transportation
Rovers:
Pressurized,
Unpressurized ,
Unmanned
User
Accommodations
Laboratories,
Deployment,
Exploration,
Operations
ISRU
Mining, Propellants,
Building Materials
Energy
Generation,
Distribution,
Conversion
Human Systems
Habitats, Life Support,
EVA Systems
TMIM
Communications,
Information Systems,
Navigation
Launch &
Landing
Pads, Servicing,
Load/Offload,
Fuel,
Assembly &
Construction
Equipment,
Operations

Lunar Evolution Summary

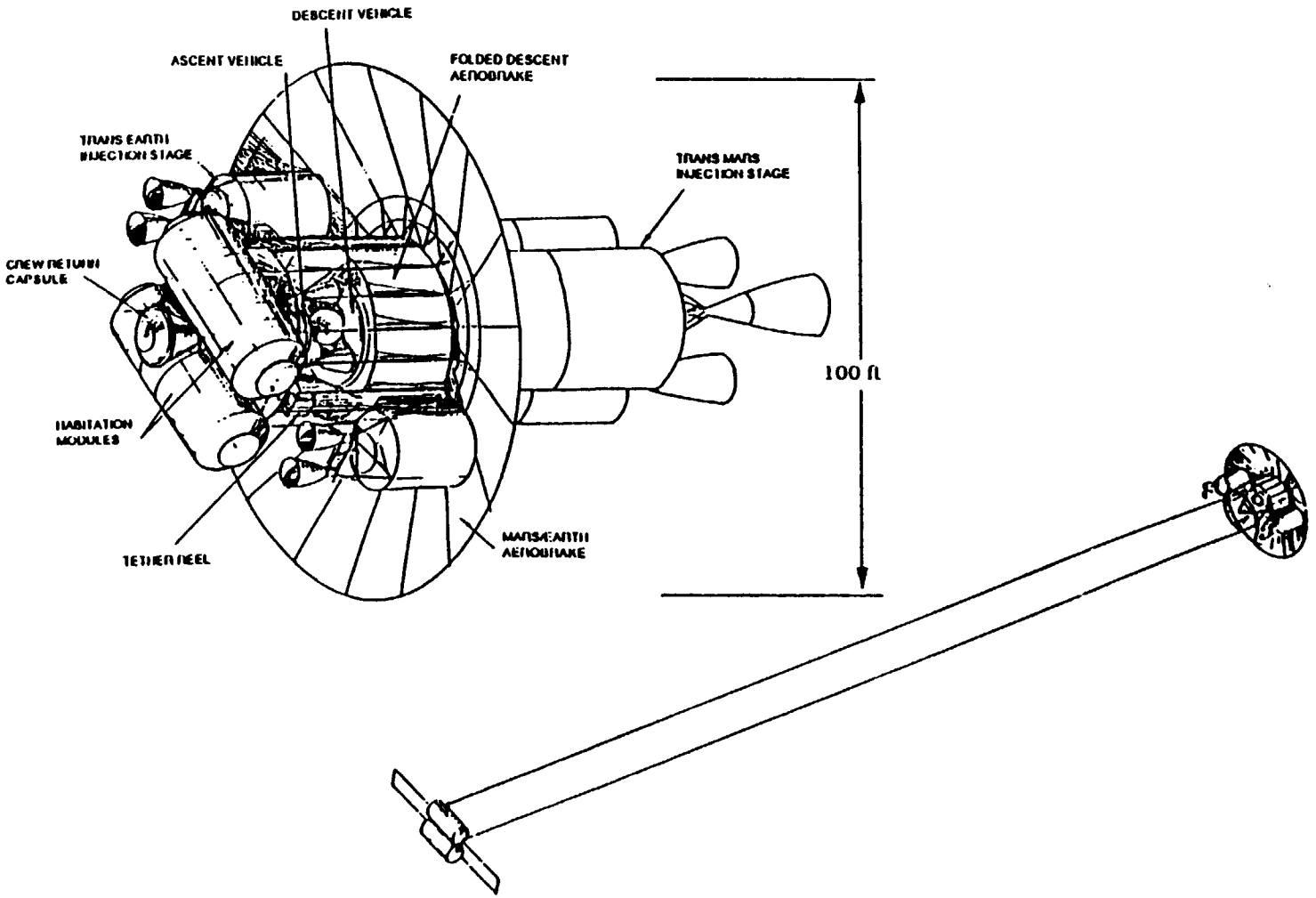


Ships of Exploration



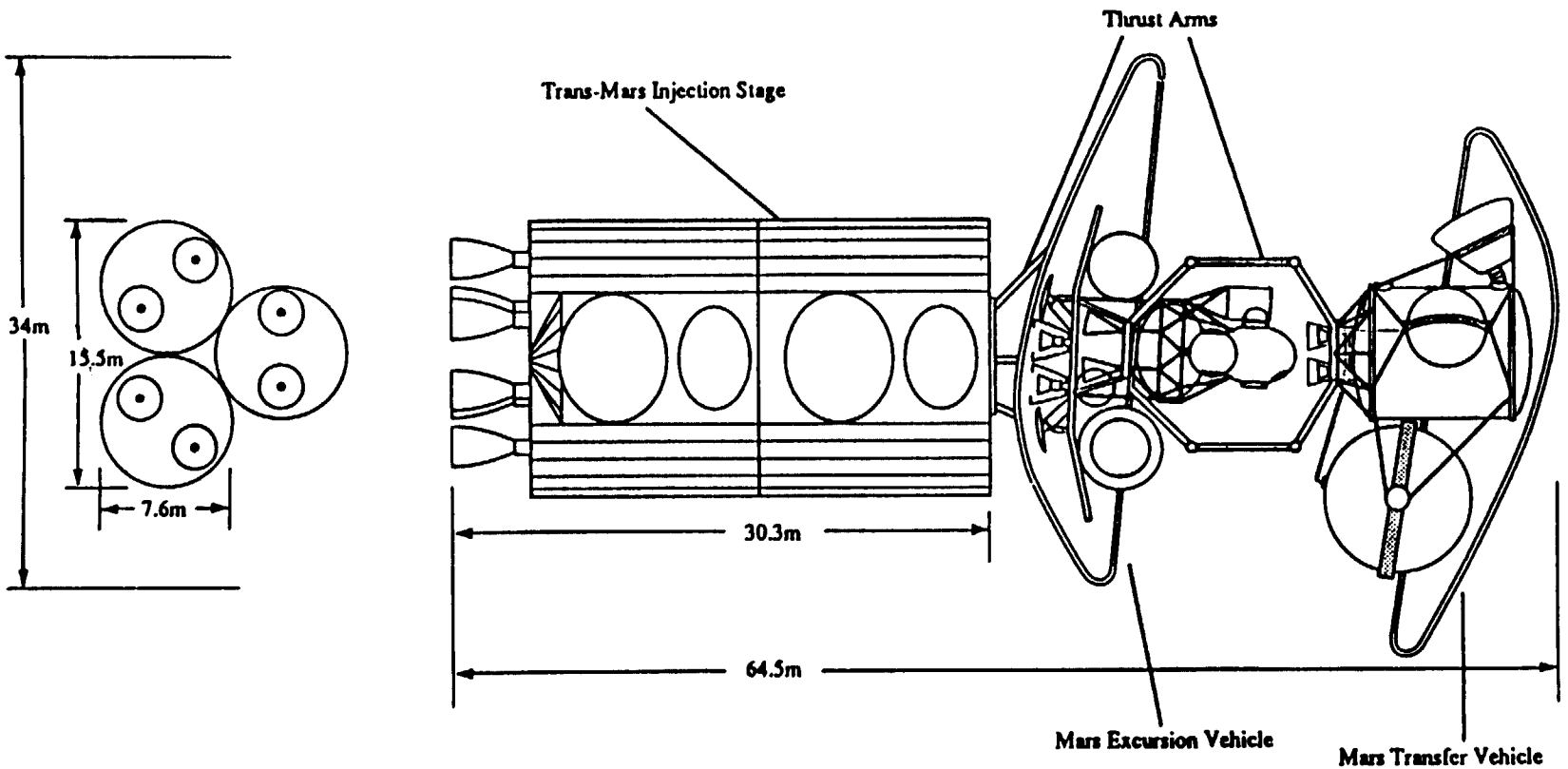
NASA

MARS SPACECRAFT



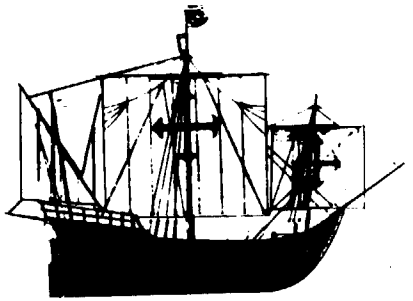
Office of Exploration

Full-up Mars Mission Vehicle in LEO



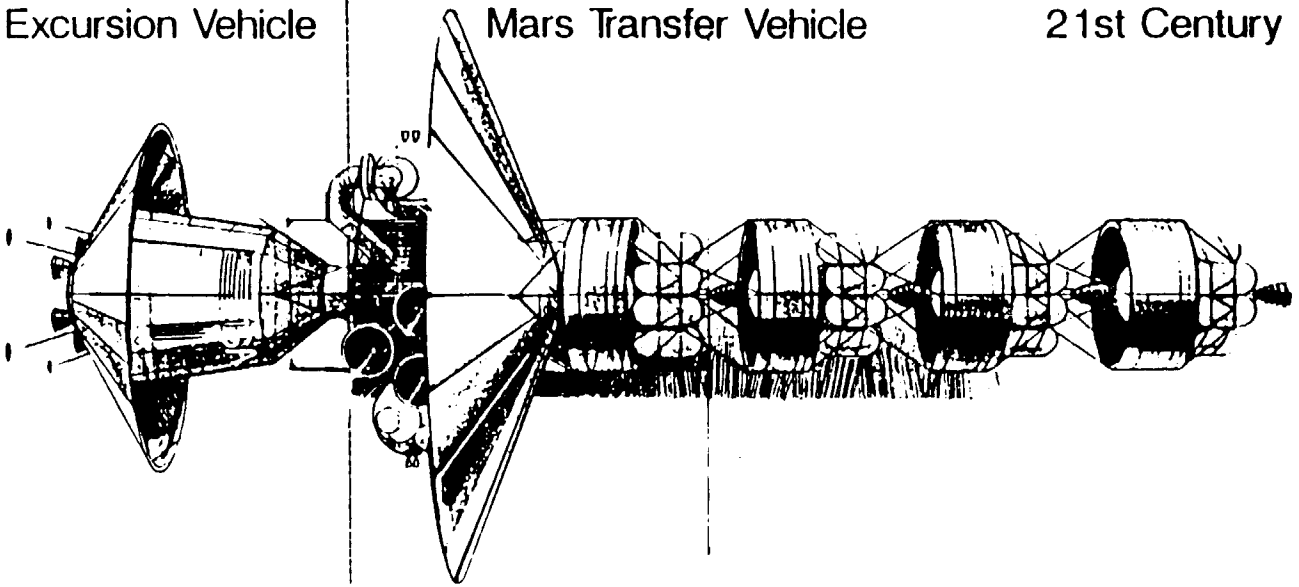
MTV	203.7t
MEV	81.6t
TMIS	526.4t
Total IMEO	811.7t

Ships of Exploration

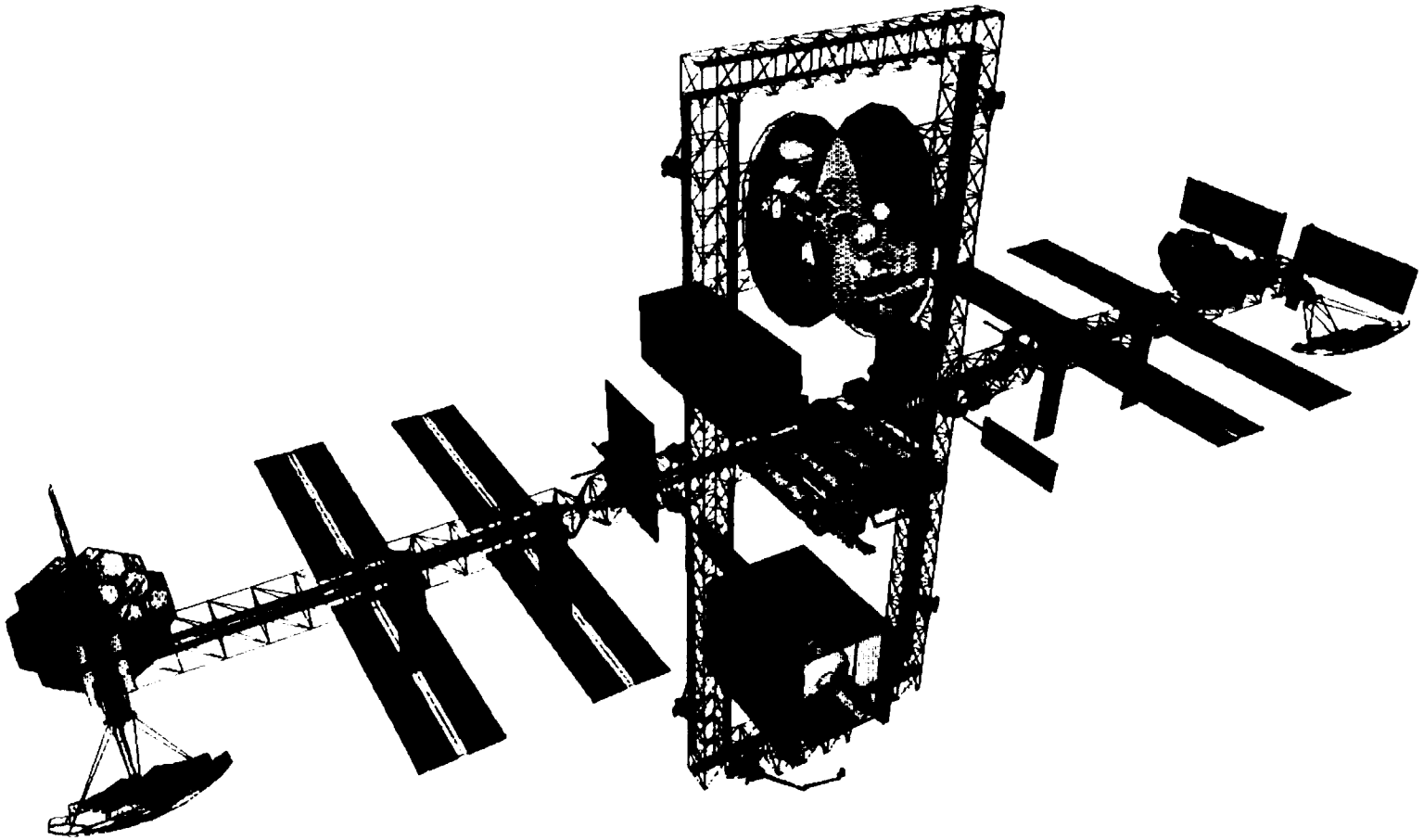


Niña 1492

Mars Excursion Vehicle | Mars Transfer Vehicle | 21st Century

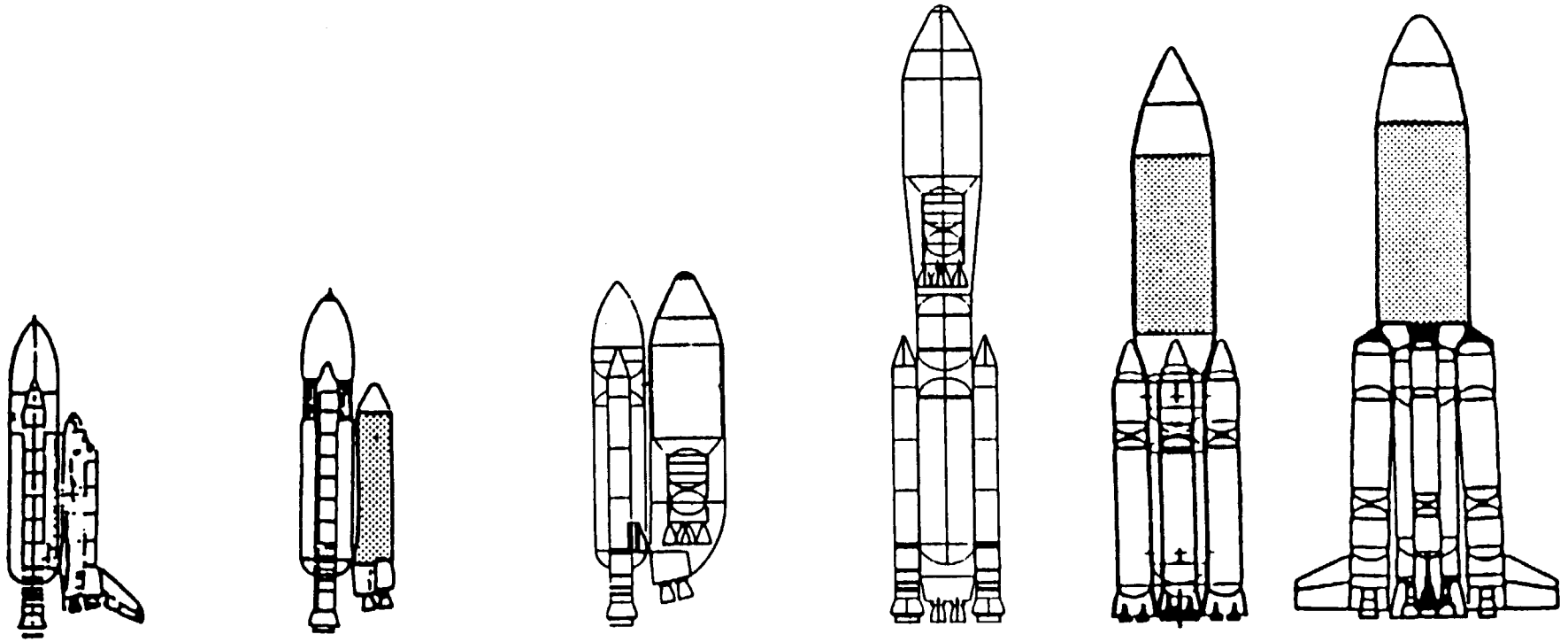


LUNAR/MARS TRANSPORTATION NODE



LaRC SSFO

SHUTTLE - DERIVED LAUNCH VEHICLES



STS	SHUTTLE C	SHUTTLE Z	SHUTTLE - DERIVED VEHICLES		
	SIDEMOUNT	SIDEMOUNT	INLINE	INLINE	INLINE
		THIRD STAGE	THIRD STAGE	LIQUID STRAPONS	LIQUID STRAPONS
			MORE ASRMs		BIGGER CORE

Lunar/Mars Space Transportation Systems Technology/Advanced Development

• Most Critical Areas of Technology/Advanced Development

Lunar

- Aerobrake
- Space Transfer Engine
- Cryogenic Storage and Transfer
- Cryogenic Aux. Propulsion

Mars

- Lightweight Aerobrakes
- Cryogenic Storage Transfer
- On-Orbit Assy & Veh Process.
- Space Transfer/Landing Engines
- ECLSS for Long-Duration Missions
- Alternate Propulsion Technology
  - Nuclear Thermal/Solar Electric

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